IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No	:	10/596,489	Confirmation No. :	7292
Applicant	:	Abdur-Rashid, Kamaluddin		
IFD	:	December 15, 2004		
Title	:	Asymmetric Imine Hydrogenation Processes		
TC./A.U.	:	1621		
Examiner	:	Nwaonicha, Chukwuma O		
Docket No.	:	14696-13		

Honorable Commissioner for Patents
P. O. Box 1450
Alexandria, Virginia 22313–1450

Dear Sir:

DECLARATION UNDER 37 CFR §1.132

I, Kamaluddin Abdur-Rashid, a citizen of Canada, and resident of Mississauga, Ontario, Canada, declare that the following facts are within my knowledge and are true.

1. I reside at 3414 Joan Drive, Mississauga, Ontario, Canada L5B 1T5.

2. I am currently the President and Chief Technical Officer of Kanata Chemical Technologies Inc., 101 College Street, Office 230, MaRS Centre, South Tower, Toronto, Ontario, Canada, M5G 1L7.

3. I have been working in the area of transition metal catalysts since 1998. My curriculum vitae is attached to this Declaration as Exhibit A.

4. I am the inventor of the subject matter as claimed in U.S. Patent Application No. 10/596,489 with an international filing date of December 15, 2004 (hereafter "the Application").

5. I have read and understood the disclosure and claims of the Application.

6. I have read and understood the Office Action and Advisory Action that issued for the Application on May 30, 2008 and October 8, 2008, respectively. The Examiner is of the view that claims 1, 3, 5-19 and 25-53 are obvious in view of Cobley et al. (US 6,528,687).

7. I have read and understood the claims that are attached to this Declaration as Exhibit B and are filed in response to the Office Action dated May 30, 2008 and the Advisory Action dated October 8, 2008. My comments below are based on the amended claims in Exhibit B (hereinafter "the amended claims").

8. The amended claims are directed to a process for the hydrogenation of an imine, wherein the substituents attached to the imine nitrogen are selected from optionally substituted C_1 to C_2 alkyl and optionally substituted C_{3-10}cycloalkyl and neither of the groups attached to the imine carbon are H. As will be discussed below, these substituents result in unactivated imines, which are more difficult to hydrogenate as compared to activated imines. The hydrogenation is performed at a hydrogen pressure of between 30 bar and 80 bar.

9. Cobley describes a process for the preparation of amines from the corresponding imine. All of the substituents on the imine nitrogen disclosed in Cobley are either aryl or aryl-CH_2- (i.e. benzyl) or the imine nitrogen forms part of a ring. Those skilled in the art would understand that these types of substituted imines are activated, with the corresponding hydrogenation process being more facile.

10. On the contrary, none of the imines disclosed in the amended claims possess an activating substituent.

11. We have performed direct side-by-side comparison reactions to confirm that the imines as disclosed in the amended claims would not be hydrogenated using the conditions as described in Cobley.

12. The general procedure for the H_2-hydrogenation of a single imine was as follows: The substrate solution was prepared by dissolving the imine (0.5 mmol, 100 equiv.) in 1.5 mL of deuterated benzene under an atmosphere of argon. The catalyst solution was prepared by dissolving the catalyst (0.005 mmol, 1 equiv.) in 1.5 mL of deuterated benzene under an argon atmosphere. The substrate solution and the catalyst solution were then injected into a 100 mL autoclave which already contains a weighed sample of KO^tBu (20 or 100 equiv.) suspended in 2 mL of deuterated benzene under an atmosphere of H_2. The autoclave was pressurized to 15 bar of H_2 and the reaction mixture was stirred at 50 °C. After 18 to 19 hours, the sample was submitted for NMR spectroscopy.

13. The results for the following reaction are shown in Table 1:

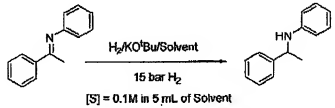


Table 1

Entry	Cat.	Substrate:Cat:Base	Solvent	Time (h)	Conv. (%)
1	$RuCl_2$(*R*-binap)(*R*,*R*-dach)	100:1:20	benzene	18	97
2	$RuCl_2$(*R*-binap)(*R*,*R*-dpen)	100:1:20	benzene	18	49

14. The results for the following reaction are shown in Table 2:

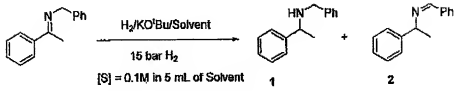


Table 2

Entry	Cat.	Substrate:Cat:Base	Solvent	Time (h)	Conv. (%)
1	$RuCl_2$(*R*-binap)(*R*,*R*-dach)	100:1:20	benzene	20	85
2	$RuCl_2$(*R*-binap)(*R*,*R*-dpen)	100:1:20	benzene	20	82

15. The results for the following reaction are shown in Table 3:

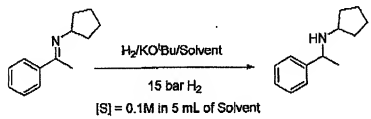
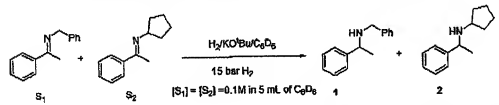


Table 3

Entry	Cat	Substrate:Cat:Base	Solvent	Time (h)	Conv. (%)
1	$RuCl_2$(*R*-binap)(*R*,*R*-dach)	100:1:20	benzene	19	7.5
2	$RuCl_2$(*R*-binap)(*R*,*R*-dach)	100:1:100	benzene	19	7.5
3	$RuCl_2$(*R*-binap)(*R*,*R*-dpen)	100:1:20	benzene	19	5
4	$RuCl_2$(*R*-binap)(*R*,*R*-dpen)	100:1:100	benzene	19	6.5

16. The general procedure for the H_2-hydrogenation of mixture of imines in C_6D_6 was as follows: Under argon, the solution of the two substrates was prepared by dissolution of the two imines (0.5 mmol each, 100 equiv. each) in 1.5 mL of C_6D_6. The catalyst solution was prepared by dissolution of the catalyst (0.005 mmol, 1 equiv.) in 1.5 mL of C_6D_6. The substrate solution and the catalyst solution were then injected into a 100 mL autoclave which already contains a suspension of KO^tBu (20 equiv.) in 2 mL of C_6D_6 under an atmosphere of H_2. The autoclave was pressurized to 15 bar of H_2 and the reaction mixture was stirred at 50 °C. After 21 hours, the sample was submitted for NMR spectrometry.

17. The results for the following reaction are shown in Table 4:



Entry	Cat	S_1:C:B = S_2:C:B	Time (h)	Conv./S 1 (%)	Conv./S 2 (%)
1	$RuCl_2$(*R*-binap)(*R*,*R*-dach)	100:1:20	21	76	4
2	$RuCl_2$(*R*-binap)(*R*,*R*-dpen)	100:1:20	21	91	7

18. The results provide in points 13 and 14 illustrate activated imines (phenyl and benzyl substituted) being hydrogenated using the conditions described in Cobley. As reported in Tables 1 and 2, the conversion of the activated imines to the corresponding amines is quite high, ranging from 49% to 97%.

19. Illustrated in point 15 is the attempted hydrogenation of an unactivated imine. Using the conditions described in Cobley, an unactivated cyclopenyl-substituted imine is converted to the corresponding amine in yields of only about 7% (Table 3). It is noted that the unactivated cyclopenyl-substituted imine tested

in point 15 is claimed by the amended claims. It is submitted that this experimental data provides evidence to support the contention that the process disclosed in Cobley will not hydrogenate unactivated imines.

20. In point 17, a direct comparison of the hydrogenation of an activated imine (benzyl-substituted imine) and an unactivated imine (cyclopentyl-substituted imine) is carried out in the same reaction vessel. Again, the conditions disclosed in Cobley were used and illustrate that only the activated imine is converted to the corresponding amine in good yield. It is submitted that this provides further evidence that the processes described in Cobley are not able to hydrogenate unactivated imines.

21. In Example 1.7 of the Application, the same unactivated cyclopenyl-susbtituted imine that is shown in points 15 and 17 is hydrogenated using the conditions as disclosed in the Application. As illustrated in this Example, the imine was converted to the corresponding amine using various catalysts in yields ranging between 83% to 97%.

22. Examples 1.2, 1.3, 1.5 and 1.6 of the Application further illustrate the hydrogenation of various unactivated amines (for example, methyl and ethyl substituted imines), with some yields of the corresponding amine at 100%.

23. It is therefore submitted that the experimental results provided in this declaration and the data shown in Examples 1.2, 1.3, 1.5, 1.6 and 1.7 of the Application, illustrate the fundamental difference between the subject matter disclosed in Cobley and that disclosed in the present Application. Cobley discloses the hydrogenation of activated amines. However, as illustrated by the data submitted herein, the processes disclosed in Cobley are not able to hydrogenate unactivated imines.

24. In summary, I believe that I am entitled to claim a process for the hydrogenation of an imine of the Formula (I) to an amine of Formula (II), as specified in the amended claims. I am of the opinion that the amended claims are not obvious in view of Cobley, since the processes disclosed in Cobley are not useful for the hydrogenation of unactivated imines. This is supported by the fact that the process of Cobley is only able convert a cyclopenyl-substituted imine to the corresponding amine using various catalysts in a yield ranging between 5% and 7.5%. On the contrary, the process of the present application converts the same imine in a yield ranging between 83% and 97%. Accordingly, it is submitted that the processes disclosed by Cobley are not able to hydrogenate unactivated imines.

25. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statement and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the Application or patent resulting therefrom.

November 30, 2008
Date

Kamaluddin Abdur-Rashid

EXHIBIT A

Kamaluddin Abdur-Rashid

Profile
Experimental and synthetic chemist in organometallic chemistry and catalysis.

Citizenship: Canadian.
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Education

1989-1994	Ph.D (Inorganic Chemistry), University of the West Indies, Mona, Jamaica, W.I.
1986-1989	B.Sc. (Honours, Special Chemistry), University of the West Indies, Mona, Jamaica, W.I.

Employment History

2004-Present	**Founder, President and Chief Technology Officer**, Kanata Chemical Technologies Inc. **Field and duties:** Overall authority, overseeing of R&D, production, marketing, sales, technology acquisition and licensing.
2002-2003	**Research Associate** (Inorganic/Organometallic Chemistry and Catalysis), Wilfrid Laurier University.
1998-2002	**Research Associate** (Organometallic Chemistry and Catalysis), University of Toronto.
1998-2001	**Tutor, Demonstrator, Substitute Lecturer** (University of Toronto)
1994-1997	**Assistant Lecturer** (University of the West Indies, Mona)
1992-1993	**Teaching Assistant** (University of the West Indies, Mona)
1991	**Lecturer** (College of Arts, Science and Technology, Kingston, Jamaica, W.I.)

Research Specialty
Current research focuses on the design, synthesis and chemistry of new classes of ligands and their transition metal complexes. The primary interest is the use of these compounds for industrial catalytic applications.

Professional Affiliations
The Chemical Institute of Canada
The Canadian Society for Chemistry
The American Chemical Society

International Conferences and Seminars attended

2008 CPhI Worldwide (Frankfurt, Germany)
2008 American Chemical Society 236nd National Meeting (Philadelphia, Pennsylvania)
2008 Informex USA (New Orleans, Louisiana)
2007 CPhI Worldwide (Milan, Italy)
2007 American Chemical Society 234nd National Meeting (Boston, Massachusetts)
2007 Canadian Society for Chemistry 90th Conference and Exhibition (Winnipeg, Manitoba)
2007 Informex USA (San Francisco, California)
2006 American Chemical Society 232nd National Meeting (San Francisco, California)
2006 Canadian Society for Chemistry 89th Conference and Exhibition (Halifax, Nova Scotia)
2005 American Chemical Society 230th National Meeting (Washington, DC)
2004 Canadian Society for Chemistry 87th Conference and Exhibition (London, Ontario)
2003 The 39th IUPAC Congress and 86th CSC meeting (Ottawa, Ontario)
2002 American Chemical Society 224th National Meeting (Boston, Massachusetts)
2002 Canadian Society for Chemistry 85th Conference and Exhibition (Vancouver, B.C.)
2001 American Chemical Society 222nd National Meeting (Chicago, Illinois)
2001 Canadian Society for Chemistry 84th Conference and Exhibition (Montreal, Quebec)
2000 Canadian Society for Chemistry 83rd Conference and Exhibition (Calgary, Alberta)
1999 Canadian Society for Chemistry 82nd Conference and Exhibition (Toronto, Ontario)
1997 American Chemical Society 214th National Meeting (San Francisco, California)
1996 American Chemical Society 213th National Meeting (Orlando, Florida)
1995 International Union of Pure and Applied Chemistry 35th Congress (Istanbul, Turkey)
1995 XIth Caribbean Conference of Chemistry and Chemical Engineering (Trinidad, W.I.)
1993 IUPAC 23rd International Conference on Solution Chemistry (Leicester, U.K.)
1990 Royal Society of Chemistry 5th International Conference on Mechanisms of Reactions in Solution (University of Kent, Canterbury, U.K.)

Publications

1. Highly Active Iridium Catalysts for the Hydrogenation of Ketones and Aldehydes. **K. Abdur-Rashid**, Xuanhua Chen, Wenli Jia, Rongwei Guo, Todd. W. Graham and Meredith A Gullons, Dalton Trans., 2008, In Press.
2. Aminophosphine Catalysts in Modern Asymmetric Synthesis. **K. Abdur-Rashid**, Dino Amoroso, Todd W. Graham, Rongwei Guo and Chi-Wing Tsang, Aldrichimica Acta, 2008, 41, 15-26.
3. [(R)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl-κ^2-P,P']chlorohydrido{(S)-2-methyl-1-[(4R,5R)-4-methyl-5-phenyl-4,5-dihydrooxazol-2-yl]propan-1-amine-κ^2-N,N'}ruthenium(II) benzene solvate: An Active Ketone Hydrogenation Catalyst. **K. Abdur-Rashid** and Alan J. Lough, Acta Crystallographica, 2007, E63, 246-248.
4. Carbene vs. Olefin Products of C-H Activation on Ruthenium via Competing α- and β-H Elimination. **K. Abdur-Rashid**, Vladimir F. Kuznetsov, Alan J. Lough and Dmitry G. Gusev, J. Am. Chem. Soc., 2006, 128, 14388-14396.
5. A Family of Active Iridium Catalysts for Transfer Hydrogenation of Ketones. **K. Abdur-Rashid**, Z. Clarke, P.T. Maragh, T.P. Dasgupta, D.G. Gusev, and Alan J. Lough, Organometallics, 2006, 25, 4113-4117.

6. Chemistry of Ruthenium(II) Monohydride and Dihydride Complexes Containing Pyridyl Donor Ligands Including Catalytic Ketone H_2-Hydrogenation. **K. Abdur-Rashid**, R. Abbel, A.J. Lough and R.H. Morris, Inorg. Chem., 2005, 44, 2483-2492.
7. Synthesis of Ruthenium Hydride Complexes Containing Beta-Aminophosphine Ligands and their use in the Hydrogenation of Ketones and Imines. **K. Abdur-Rashid**, R. Guo, A.J. Lough, R.H. Morris and D. Song, Adv. Synth. Catal., 2005, 347, 571-579.
8. A Cascade of Dihydride Isomers of Ruthenium. Which One is the Ketone Hydrogenation Catalyst? **K. Abdur-Rashid**, R. Abbel, M. Faatz, A. Hadzovic, A.J. Lough and R.H. Morris, J. Am. Chem. Soc., 2005, 127, 1870-1882.
9. Dihydridoamine and Hydridoamido Complexes of Ruthenium(II) With Tetradentate PNNP Donor Ligands. **K. Abdur-Rashid**, T. Li, R. Churlaud, A.J. Lough and R.H. Morris, Organometallics, 2004, 23, 6239-6247.
10. Coordinatively Unsaturated Hydridoruthenium(II) Complexes of N-Heterocyclic Carbenes. **K. Abdur-Rashid**, T. Fedorkiw, A.J. Lough and R.H. Morris, Organometallics, 2004, 23, 86-94.
11. Hydrogenation versus Transfer Hydrogenation of Ketones: Two Established Ruthenium Systems Catalyze Both. V. Rautenstrauch, X. Hoang-Cong, R. Churlaud, **K. Abdur-Rashid** and R.H. Morris, Chem. Eur. J. 2003, 9, 4954-4967.
12. Optical Sensing Behavior of the Ruthenim(II) complex of Di-2-pyridylketone-p-nitrophenylhydrazone, $[Ru(bipy)_2(dpknph)]Cl_2$, M. Bakir, **K. Abdur-Rashid** and C. Gyles, Spectrochim. Acta, Part A, 2003, 59, 2123-2129.
13. Mechanism of the Hydrogenation of Ketones Catalysed by Transdihydrido(diamine) ruthenium(II) complexes. **K. Abdur-Rashid**, M. Faatz, S. Clapham, A. Hadzovic, J.N. Harvey, A.J. Lough and R.H. Morris, J. Am. Chem. Soc., 2002, 124, 15104-15118.
14. Catalytic Cycle for the Asymmetric Hydrogenation of Prochiral Ketones to Chiral Alcohols: Direct Hydride and Proton Transfer from Chiral Catalysts trans-RuH_2(diphosphine)(diamine) to Ketones and Direct Addition of Dihydrogen to the Resulting Hydridoamido Complexes. **K. Abdur-Rashid**, M. Faatz, A.J. Lough and R.H. Morris, J. Am. Chem. Soc., 2001, 123, 7473-7474.
15. Ruthenium Monohydrides RuHCl(Diphosphine)(Diamine): Catalyst Precursors for the Stereoselective Hydrogenation of Ketones and Imines. **K. Abdur-Rashid**, A.J. Lough and R.H. Morris, Organometallics, 2001, 20, 1047-1049.
16. Intra- and Inter-Ion-Pair Protonic-Hydridic Bonding in Polyhydridobis(phosphine)rhenates. **K. Abdur-Rashid**, A.J. Lough and R.H. Morris, Can. J. Chem. (Special issue to Brian R. James), 2001, 79, 964-976.
17. Synthesis, Structure and Reactivity of the New Rhenium Anionic Polyhydride Dimer Salts $[K(Q)][\{ReH_2(PR_3)_2\}_2(\mu\text{-}H_3)]$; Q = 18-Crown-6, 1,10-diaza-18-Crown-6. J. Hinman, **K. Abdur-Rashid**, A.J. Lough and R.H. Morris, Inorg. Chem., 2001, 40, 2480-2481.
18. An Acidity Scale in THF for Molecular Hydrogen and Phosphorus-containing Compounds Including Metal Hydrides and Dihydrogen Complexes. **K. Abdur-Rashid**, T. Fong, B. Greaves, D.G. Gusev, S.E. Landau, A.J. Lough and R.H. Morris, J. Am. Chem. Soc., 2000, 122, 9155-9171.
19. Ruthenium dihydride $RuH_2(PPh_3)_2$(R,R-Cyclohexyldiamine) and Ruthenium Monohydride $RuHCl(PPh_3)_2$(R,R-Cyclohexyldiamine): Active Catalyst and Catalyst Precursor for the Hydrogenation of Ketones and Imines. **K. Abdur-Rashid**, A.J. Lough and R.H. Morris,

Organometallics, 2000, 19, 2655-2657.

20. Synthesis, Characterization and Related Chemistry of $RuH_2(H_2)_2(P^iPr_3)_2$. Evidence for a Bis(dihydrogen) Structure and Related chemistry. **K. Abdur-Rashid**, D.G. Gusev, A.J. Lough and R.H. Morris, Organometallics, 2000, 19, 1652-1660.
21. Intermolecular Proton-Hydride Bonding in Ion Pairs: Synthesis and Structural Properties of $[K(Q)][M(H)_5(P^iPr_3)_2]$, M = Os, Ru; Q =18-crown-6, 1-aza-18-crown-6 and 1,10-diaza-18-crown-6. **K. Abdur-Rashid**, D.G. Gusev, A.J. Lough and R.H. Morris, Organometallics, 2000, 19, 834-843.
22. Thermodynamics and Optical-Sensing Properties of *fac*-$Re(CO)_3$(dpknph)Cl (dpknph = di-2-pyridyl ketone p-nitrophenyl hydrazone). M. Bakir and **K. Abdur-Rashid**, Talanta, 2000, 51, 735-741.
23. Electro-optical Properties of the Rhenium-Hydrazone complex, *fac*-$Re(CO)_3$(dpknph)Cl (dpknph = di-2-pyridyl ketone p-nitrophenyl hydrazone). M. Bakir and **K. Abdur-Rashid**, Transition Met. Chem., 1999, 24, 384-388.
24. Organizing Chain Structures by Use of Proton-Hydride Bonding. The single Crystal X-ray Diffraction Structures of $[K(Q)][Os(H)_5(P^iPr_3)_2]$ and $[K(Q)][Ir(H)_4(P^iPr_3)_2]$, Q = 18-crown-6 and 1,10-diaza-18-crown-6. **K. Abdur-Rashid**, D.G. Gusev, S.E. Landau, A.J. Lough and R.H. Morris, J. Am. Chem. Soc. 1998, 120, 11826-11827.
25. Kinetics of the Oxidation of Ascorbate by Tetranuclear Cobalt(III) Complexes ("Hexols") in Aqueous Solution. **K. Abdur-Rashid**, T.P. Dasgupta and J. Burgess, J. Chem. Soc. Dalton Trans., 1393 - 1398, 1996.
26. Kinetics and Mechanism of the Oxidation of L-Ascorbic Acid by Cis-diaqua Cobalt(III) Ammine Complexes. **K. Abdur-Rashid**, T.P. Dasgupta and J. Burgess, J. Chem. Soc. Dalton Trans., 1385 - 1391, 1996.
27. Reactivity of the Tri-μ-hydroxo-bis[triamminecobalt(III)] Ion in Halide Media. **K. Abdur-Rashid**, T.P. Dasgupta and J. Burgess, J. Chem. Soc. Dalton Trans., 2327 - 2330, 1994.
28. Solvation of Cobalt(III) Complexes: Partial Molar Volumes and Transfer Chemical Potentials. N.J. Blundell, J. Burgess, T.P. Dasgupta, **K. Abdur-Rashid** and P. Guardado, J. Indian Chem. Soc., 69, 426 - 432, 1992.

Presentations at Professional Meetings

1. Ruthenium aminophosphine catalysts $RuCl_2$(aminophosphine)$_2$ and $RuCl_2$(diphosphine)-(aminophosphine) for the hydrogenation of ketones and imines, **K. Abdur-Rashid**. Presented at the American Chemical Society 234th National Meeting, Boston, Massachusetts, Aug 19-23, 2007.
2. Practical Catalytic Hydrogenation Catalysts and Processes, **K. Abdur-Rashid**, Rongwei Guo, Wenli Jia and Xuanhua Chen. Presented at the 90th CSC meeting, Winnipeg, Manitoba, May 26-30, 2007.
3. Aminophosphine Catalysts for Hydrogenation and Transfer Hydrogenation of Ketones and Imines, **K. Abdur-Rashid**. Presented at the American Chemical Society 230th National Meeting, Washington, DC, Aug 28-Sept 1, 2005.
4. New Bifunctional Catalysts for the Hydrogenation and Transfer Hydrogenation of Ketones and Imines, **K. Abdur-Rashid**. Presented at the 37th Inorganic Discussion Weekend, Queens University, Kingston, Ontario, Canada, November 5-7, 2004.
5. Practical Catalytic Asymmetric Hydrogenation of Imines Facilitated by Functional Molecular

Recognition, **K. Abdur-Rashid**. Presented at The 87th CSC meeting, London, Ontario, May 29-June 1, 2004.

6. Playing with the Bifunctional RuH···HN effect in ketone and imine hydrogenation catalysis, R.H. Morris, **K. Abdur-Rashid**, Rongwei Guo, Alan J. Lough, Tianshu Li and Datong Song. Presented at The 87th CSC meeting, London, Ontario, May 29-June 1, 2004.
7. Ruthenium Tetradentate Trans-Dihydride and Amido Complexes Derived from the Precatalyst for Ketone Hydrogenation, T. Li, A.J. Lough, R. Churlaud, **K. Abdur-Rashid** and R.H. Morris. Presented at the 36th Inorganic Discussion Weekend, McMaster University, Hamilton, Ontario, Canada, October 31 – November 2, 2003.
8. Bifunctional Aminodiphosphine Pincer Ligands and their Transition Metal Complexes, **K. Abdur-Rashid**, Alan J. Lough and Dmitry G. Gusev. Presented at the 36th Inorganic Discussion Weekend, McMaster University, Hamilton, Ontario, Canada, October 31 – November 2, 2003.
9. Trans-Dihydride and Amido Complexes Derived from the Precatalyst for Ketone Hydrogenation, Trans-RuHCl{PNHtmeNHP}, where {PNHtmeNHP} is a Tetradentate Ligand, T. Li, A.J. Lough, R. Churlaud, **K. Abdur-Rashid** and R.H. Morris. Presented at the American Chemical Society 226th National Meeting, New York City, New York, September 7-11, 2003.
10. Aminodiphosphine Pincer Ligands and their Transition Metal Complexes, **K. Abdur-Rashid**, Alan J. Lough and Dmitry G. Gusev. Presented at The 39th IUPAC Congress and 86th CSC meeting, Ottawa, Ontario, August 10-15, 2003.
11. A Cascade of Dihydride Isomers of Ruthenium, Which One is the Ketone Hydrogenation Catalyst? A. Hadzovic, R. Abbel, A.J. Lough, R.H. Morris, **K. Abdur-Rashid** and J. Harvey. Presented at The 39th IUPAC Congress and 86th CSC meeting, Ottawa, Ontario, August 10-15, 2003.
12. New Pincer Complexes Containing a Bulky Diphosphinamine Ligand, **K. Abdur-Rashid**, A.J. Lough and D.G. Gusev. Presented at the 35th Inorganic Discussion Weekend, Montreal, Quebec, Canada, October 25-27, 2001.
13. Kinetic and Modeling Studies of the Hydrogenation of Acetophenone by the Novel Hydridoamido Catalyst $RuH(NHCMe_2CMe_2NH_2)(PPh_3)_2$, S. Clapham, **K. Abdur-Rashid**, A.J. Lough, and R.H. Morris. Presented at the 35th Inorganic Discussion Weekend, Montreal, Quebec, Canada, October 25-27, 2001.
14. New Hydride Complexes of Ruthenium and Iridium Bearing N-Heterocyclic Carbene Ligands, R.H. Morris, **K. Abdur-Rashid**, T. Fedorkiw, Leonie Soltay and A.J. Lough. Presented at the 35th Inorganic Discussion Weekend, Montreal, Quebec, Canada, October 25-27, 2001.
15. Mechanism of the Hydrogenation of Ketones Catalysed by Dihydrido(diamine) ruthenium(II) complexes. R.H. Morris, **K. Abdur-Rashid**, M. Faatz, S. Clapham, A. Hadzovic, J.N. Harvey, A.J. Lough. Presented at the American Chemical Society 224th National Meeting, Boston, Massachusetts, August 18-22, 2002.
16. Chemistry of Ruthenium(II) Monohydride and Dihydride Complexes Containing Nitrogen Donor Ligands: Evidence for an Ionic Mechanism in Catalytic Hydrogenation Reactions. **K. Abdur-Rashid**, M. Faatz, A. Hadzovic, A.J. Lough and R.H. Morris. Presented at the Canadian Society for Chemistry 85th Conference, Vancouver, British Columbia, Canada, May 2002.

17. The Activation of Dihydrogen by Ruthenium Amido Complexes as the Turnover Limiting Step of Ketone Asymmetric Hydrogenation Catalysts. R.H. Morris, **K. Abdur-Rashid**, M. Faatz, S. Clapham, A. Hadzovic, J.N. Harvey, A.J. Lough. Presented at the Canadian Society for Chemistry 85th Conference, Vancouver, British Columbia, Canada, May 2002.
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20. Ionic Asymmetric Hydrogenation: Direct Hydride and Proton Transfer from Chiral Catalysts trans-RuH_2(diphosphine)(diamine) to Ketones and Imines. **K. Abdur-Rashid**, S. Clapham, M. Faatz, A.J. Lough and R.H. Morris. Presented at the American Chemical Society 222nd National Meeting, Chicago, Illinois, August 26-30, 2001.
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22. Synthesis, Characterization and Reactivity of the Ruthenium Dihydride Complexes $RuH_2(PPh_3)_2$(N-N); N-N = Bipyridine, 1,10-Phenanthroline and R,R-Cyclohexyldiamine: Evidence for an Unconventional Proton-Hydride Tranfer Mechanism in Ketone Hydrogenation. **K. Abdur-Rashid**, A.J. Lough and R.H. Morris. Presented at the 33rd Inorganic Discussion Weekend, University of York, Toronto, Ontario, Canada, October 27-29, 2000.
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26. RuH_2(phosphine)$_2$(diamine) and RuHCl(phosphine)$_2$(diamine): Catalyst and Catalyst Precursor for the Hydrogenation of Ketones and Imines. **K. Abdur-Rashid**, A.J. Lough and R.H. Morris. Presented at the Canadian Society for Chemistry 83rd Conference, Calgary, Alberta, Canada, May 2000.
27. Synthesis, Characterization and Reactivity of the Bisdihydrogen Complex, $RuI_2(H_2)_2(P^iPr_3)_2$, and the Bisdinitrogen Complexes, $RuH_2(N_2)_2(P^iPr_3)_2$ and $\{RuH_2(N_2)(P^iPr_3)_2\}_2(\mu\text{-}N_2)$. **K. Abdur-Rashid**, A.J. Lough and R.H. Morris. Presented at the Canadian Society for Chemistry 83rd Conference, Calgary, Alberta, Canada, May 2000.
28. Ruthenium(II) Hydrogenation Catalysts Activated by Proton-Hydride Bonds. **K. Abdur-**

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29. An Acidity Scale in THF for Molecular Hydrogen and for Phosphorus Containing Compounds Including Metal Hydrides and Dihydrogen Compounds. **K. Abdur-Rashid**, T.P Fong, B. Greaves, D.G. Gusev, S.E. Landau, A.J. Lough and R.H. Morris. Presented at the 32nd Inorganic Discussion Weekend, University of Windsor, Windsor, Ontario, Canada, October 29-31, 1999.
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32. Solvent Effects on the Oxidation of Ascorbate by Cobalt(III) Complexes. **K. Abdur-Rashid**, T.P. Dasgupta and J. Burgess. Presented at the XIth Caribbean Conference of Chemistry and Chemical Engineering, St. Augustine, Trinidad, March 6-10, 1995.
33. Solvation and Reactivity of the Cobalt(III) Triol Complex. **K. Abdur-Rashid**, T.P. Dasgupta and J. Burgess. Presented at the International Union of Pure and Applied Chemistry 23rd International Conference on Solution Chemistry, Univ. of Leicester, August 1993.
34. Solvent Effects on the Reduction of Cobalt(III) Tetranuclear Complexes by Ascorbate in Binary Aqueous Cosolvent Mixtures. **K. Abdur-Rashid**, T.P. Dasgupta and J. Burgess. Presented the International Union of Pure and Applied Chemistry 23rd International Conference on Solution Chemistry, Univ. of Leicester, August 1993.
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Invited lectures

1. From Non-Classical Hydrogen Bonding to Commercialization of Technologies from Canadian Universities. **K. Abdur-Rashid**. University of the West Indies, Jamaica, July 2008.
2. Commercialization of Technologies from Canadian Universities. **K. Abdur-Rashid**. Mount Allison University, New Brunswick, June 2007.
3. New and Exceptionally Active Catalysts for the Stereoselective Hydrogenation of Ketones and Imines. R.H. Morris and **K. Abdur-Rashid**. Chirotech Technology Limited, Unit 321 Cambridge Science Park, Milton Road, Cambridge, U.K., October 2001.
4. Non-Classical Hydrogen Bonding in Transition Metal Hydrides: Organized molecular Assemblies and Catalytic Ionic Hydrogenation of Polar Multiple Bonds. **K. Abdur-Rashid**. Department of Chemistry, University of Guelph, Ontario, Canada, April 2001.
5. Active Ruthenium Catalysts for the Hydrogenation of Imines. R.H. Morris and **K. Abdur-Rashid**. Dow Chemical Company, Midland, Michigan, October 2000.

Patents and Inventions

1. Catalytic Hydrogenation Processes. **K. Abdur-Rashid** et. al. Filed September 11, 2000;

PCT WO 200222526 A2, Europe EP1366004, USA 7317131 B2, Canada 2422029, Japan JP2004509087T T and Israel IL154822D DO.

2. Process for Hydrogenation of Carbonyl and Iminocarbonyl Compounds Using Ruthenium Catalysts Comprising Tetradentate Diiminodiphosphine Ligands. **K. Abdur-Rashid**et al. Filed November 17, 2000; PCT WO 200240155 A1, Europe EP1337334, Canada 2428824, Japan JP2004513929T T and Israel IL155869D DO, USA 6878582 B2.
3. Process for Hydrogenating Unactivated Imines Using Ruthenium Complexes as Catalysts. **K. Abdur-Rashid** et al. Filed May 15, 2002; PCT WO03097571 A1, Europe EP1503979, USA 7256311 B2, Canada 2489158, Japan JP2005525426T T, Australia 2003223806 A1 and Israel IL164915D DO.
4. Transfer Hydrogenation and Hydrogenation Processes and Catalysts. **K. Abdur-Rashid**. Filed May 02, 2003; PCT WO 2004096735 A2, Canada 2565130, USA 7291753 B2.
5. Asymmetric Imine Hydrogenation Processes. **K. Abdur-Rashid**. Filed December 15, 2003; PCT WO 2005056513, Canada 2549929, USA 2007293681.
6. Method for the Production of Hydrogen from Ammonia Borane. **K. Abdur-Rashid** et al. Filed May 18, 2007.
7. Iridium Catalysts for Catalytic Hydrogenation. **K. Abdur-Rashid** et al. Filed May 31, 2007.
8. Process for the Preparation of Aminophosphine Ligands and their use in Metal Catalysts. **K. Abdur-Rashid** et al. Filed June 8, 2007.
9. Ruthenium Catalysts for Catalytic Hydrogenation. **K. Abdur-Rashid** et. al. Filed July 6, 2007.
10. Method for the Preparation of Cis-4-tert-butylcyclohexanol. **K. Abdur-Rashid** et al. Filed July 6, 2007.
11. Cationic Hydrogenation Catalysts. **K. Abdur-Rashid** et al. Filed October 30, 2007.
12. Cationic Transition Metal Arene Catalysts. **K. Abdur-Rashid** et al. Filed May1, 2008.
13. Method for Preparing a Metal Catalyst. **K. Abdur-Rashid** et al. Filed October17, 2008.

EXHIBIT B

1. (Currently Amended) A process for the hydrogenation and/or asymmetric hydrogenation of an imine of Formula (I) to an amine of Formula (II) and/or its other enantiomer:

I

II

wherein

R^1 is selected from the group consisting of aryl and heteroaryl, which two groups are optionally substituted;

R^2 is selected from the group consisting of ~~hydrogen,~~ aryl, heteroaryl, $C_{1\text{-}10}$alkyl, $C_{2\text{-}10}$alkenyl, $C_{2\text{-}10}$alkynyl, $C_{3\text{-}10}$cycloalkyl, $C_{3\text{-}10}$cycloalkenyl and $C_{3\text{-}10}$heterocyclo, which latter eight groups are optionally substituted; and

R^3 is selected from the group consisting of optionally substituted C_1 to C_2 alkyl and optionally substituted $C_{3\text{-}10}$cycloalkyl; ~~and $-CH_2-C\equiv C-R^6$, in which R^6 is selected from the group consisting of H, aryl, $C_{1\text{-}10}$alkyl, $C_{2\text{-}10}$alkenyl, $C_{2\text{-}10}$alkynyl, $C_{3\text{-}10}$cycloalkyl and $C_{3\text{-}10}$cycloalkenyl, which latter six groups are optionally substituted;~~

wherein the optional substituents of R^1 and R^2 are independently selected from one or more of the group consisting of halo, NO_2, OR^4, NR^4_2 and R^4, in which R^4 is independently selected from one or more of the group consisting of hydrogen, aryl,

$C_{1\text{-}6}$alkyl, $C_{2\text{-}6}$alkenyl, $C_{3\text{-}6}$cycloalkyl and $C_{3\text{-}6}$cycloalkenyl;

the optional substituents of R^3 ~~and R^6~~ are independently selected from one or more of the group consisting of halo, NO_2, $OC_{1\text{-}6}$alkyl, $N(C_{1\text{-}6}alkyl)_2$ and $C_{1\text{-}6}$alkyl ~~OR^6, NR^6_2 and R^6, in which R^6 is independently selected from the group consisting of $C_{1\text{-}6}$alkyl, $C_{2\text{-}6}$alkenyl and $C_{2\text{-}6}$alkynyl~~; and

one or more of the carbon atoms in the alkyl, alkenyl and/or alkynyl groups of R^1, R^2 and/or R^3 is optionally replaced with a heteroatom selected from the group consisting of O, S, N, O and Si, which, where possible, is optionally substituted with one or more C_{1-6}alkyl groups;
said process comprising the steps of reacting imines of Formula (I) in the presence of a H_2 pressure between 30 bar and 80 bar, a base and a catalytic system in which the catalytic system comprises ~~a base and~~ a ruthenium complex comprising (I) a diamine and (2) a diphosphine ligand or monodentate phosphine ligand.

2. (Previously Cancelled)

3. (Original) The process according to claim 1, wherein the amine of Formula (II) or its opposite enantiomer, is produced in enantiomerically enriched form.

4. (Previously Cancelled)

5. (Previously Amended) The process according to claim 1, wherein R^1 is optionally substituted aryl.

6. (Original) The process according to claim 5, wherein R^1 is optionally substituted phenyl,

7. (Original) The process according to claim 6, wherein R^1 is unsubstituted phenyl.

8. (Currently Amended) The process according to claim 5, wherein R^2 is selected from the group consisting of ~~hydrogen,~~ aryl, C_{1-6}alkyl, C_{2-6}alkenyl, C_{2-6}alkynyl, C_{3-6}cycloalkyl and C_{3-6}cycloalkenyl, which latter six groups are optionally substituted.

9. (Currently Amended) The process according to claim 8, wherein R^2 is selected from the group consisting of ~~hydrogen,~~ aryl and C_{1-6}alkyl, which latter two groups are optionally substituted.

10. (Currently Amended) The process according to claim 9, wherein R^2 is selected from the group consisting of ~~hydrogen,~~ phenyl, and C_{1-6}alkyl, which latter two groups are optionally substituted.

11. (Currently Amended) The process according to claim 10, wherein R^2 is selected from the group consisting of ~~hydrogen,~~ unsubstituted phenyl and methyl.

12. (Previously Amended) The process according to claim 5, wherein R^3 is selected from the group consisting of optionally substituted C_1 to C_2 alkyl and optionally substituted C_{3-6}cycloalkyl.

13. (Original) The process according to claim 12, wherein R^3 is methyl, ethyl, i-propyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl, which latter four groups are unsubstituted.

14. (Cancelled herein)

15. (Previously Cancelled)

16. (Currently Amended) The process according to claim 5, wherein the optional substituents for R^1 and R^2 in the compounds of Formula I, are independently selected from one or more of the group consisting of halo, NO_2, OR^4, NR^4_2 and R^4, in which R^4 is independently selected from one or more of the group consisting of hydrogen, aryl and C_{1-4}alkyl, and the optional substituents of R^3 are independently selected from one or more of the group consisting of halo, NO_2, OC_{1-4}alkyl, $N(C_{1-4}$alkyl$)_2$ and C_{1-4}alkyl ~~OR^5, NR^5_2 and R^5, in which R^5 is independently selected from the group consisting of C_{1-4}alkyl~~.

17. (Original) The process according to claim 16, wherein the optional substituents for R^1 and R^2 in the compounds of Formula I, are independently selected from

one or more of the group consisting of halo, NO_2, OH, OCH_3, NH_2, $N(CH_3)_2$, CH_3 and phenyl and the optional substituents of R^3 are independently selected from one or more of the group consisting of halo, NO_2, OH, OCH_3, NH_2, $N(CH_3)_2$ and CH_3.

18. (Previously Amended) The process according to claim 5, wherein one to three of the carbon atoms in the alkyl, alkenyl and/or alkynyl groups of R^1, R^2 and/or R^3 is optionally replaced with a heteroatom selected from the group consisting of O, S, N, NH and N-CH_3.

19. (Original) The process according to claim 18, wherein suitably one of the carbon atoms in the alkyl, alkenyl and/or alkynyl groups of R^1, R^2 and/or R^3 is optionally replaced with a heteroatom selected from the group consisting of O, S, N, NH and N-CH_3.

20-24. (Previously Cancelled)

25-31. (Cancelled herein)

32. (Previously Amended) The process according to claim 1, wherein said ruthenium complex has the general Formula $RuXY(PR_3)_2(NH_2\text{-}Z\text{-}NH_2)$ (III) or $RuXY(R_2P\text{-}Q\text{-}PR_2)(NH_2\text{-}Z\text{-}NH_2)$ (IV), where Z and Q represent a chiral or achiral linker; the ancilliary ligands PR_3 and $R_2P\text{-}Q\text{-}PR_2$ represent monodentate and bidentate phosphines, respectively; and the ligands X and Y represent an anionic ligand.

33. (Original) The process according to claim 32, wherein the ligand PR_3:

PR_3

represents a chiral or achiral monodentate phosphine ligand in which R is simultaneously or independently selected from the group consisting of optionally substituted linear and branched alkyl containing 1 to 8 carbon atoms, optionally substituted linear and branched alkenyl containing 2 to 8 carbon atoms, optionally substituted cycloalkyl, optionally substituted aryl, OR and NR_2; or two R groups bonded to the same P atom are bonded together to form a ring having 5 to 8 atoms and including the phosphorous atom to which said R groups are bonded.

34. (Original) The process according to claim 32, wherein the ligand R_2P-Q-PR_2:

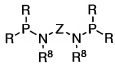
R_2P-Q-PR_2

represents a bidentate ligand in which R is simultaneously or independently selected from the group consisting of optionally substituted linear and branched alkyl containing 1 to 8 carbon atoms, optionally substituted linear and branched alkenyl containing 2 to 8 carbon atoms, optionally substituted cycloalkyl, optionally substituted aryl, OR and NR_2; or two R groups bonded to the same P atom are bonded together to form a ring having 5 to 8 atoms and including the phosphorous atom to which said R groups are bonded; and Q is selected from the group consisting of linear and cyclic C_2-C_7 alkylene, optionally substituted metallocenediyl and optionally substituted C_6-C_{22} arylene.

35. (Original) The process according to claim 34, wherein the ligand R_2P-Q-PR_2 is chiral and includes atropisomeric bis-tertiary phosphines, in which the two phosphorus atoms are linked by a biaryl backbone.

36. (Original) The process according to claim 35, wherein the ligand R_2P-Q-PR_2 is selected from the group consisting of BINAP, BIPHEP and BIPHEMP.

37. (Original) The process according to claim 32, wherein the bidentate phosphine is a chiral or achiral ligand of the type $R_2P\text{-}NR^8\text{-}Z\text{-}NR^8\text{-}PR_2$:



$R_2P\text{-}NR^8\text{-}Z\text{-}NR^8\text{-}PR_2$

wherein each R, taken separately, is independently selected from the group consisting of optionally substituted linear and branched alkyl containing 1 to 8 carbon atoms, optionally substituted linear and branched alkenyl containing 2 to 8 carbon atoms, optionally substituted cycloalkyl, optionally substituted aryl, OR and NR_2; or two R groups bonded to the same P atom are bonded together to form a ring having 5 to 8 atoms and including the phosphorous atom to which said R groups are bonded; each R^8, taken separately, is independently selected from the group consisting of hydrogen, optionally substituted linear and branched alkyl and alkenyl containing 1 to 8 carbon atoms, optionally substituted cycloalkyl, optionally substituted aryl, OR and NR_2; and Z is optionally substituted linear and cyclic C_2-C_7 alkylene, optionally substituted metallocenediyl and optionally substituted C_6-C_{22} arylene.

38. (Original) The process according to claim 37, wherein the ligand $R_2P\text{-}NR^8\text{-}Z\text{-}NR^8\text{-}PR_2$ is selected from the group consisting of DPPACH and DCYPPACH.

39. (Previously Amended) The process according to claim 1, wherein the diamine ligand has the Formula $NH_2\text{-}Z\text{-}NH_2$:

$NH_2\text{-}Z\text{-}NH_2$

wherein Z is selected from the group consisting of optionally substituted linear and cyclic C_2-C_7 alkylene, optionally substituted metallocenediyl and optionally substituted C_6-C_{22} arylene.

40. (Original) The process according to claim 39, wherein the diamine ligand is chiral and includes (1) compounds in which at least one of the amine-bearing centers is stereogenic, (2) compounds in which both of the amine-bearing centers are stereogenic and (3) atropisomeric bis-tertiary diamines, in which the two nitrogen atoms are linked by a biaryl backbone.

41. (Original) The process according to claim 39, wherein the diamine ligand NH_2-Z-NH_2 is selected from the group consisting of CYDN and DPEN.

42. (Currently Amended) The process according to claim 1, wherein the diamine is a bidentate ligand of the Formula D-Z-NHR^9 in which Z is selected from the group consisting of optionally substituted linear and cyclic C_2-C_7 alkylene, optionally substituted metallocenediyl and optionally substituted C_6-C_{22} arylene; D is an amido group donor or a chalcogenide radical selected from the group consisting of O, S, Se and Te; NHR^{69} is an amino group donor in which R^9 is selected from the group consisting of hydrogen, optionally substituted linear and branched alkyl and alkenyl containing 1 to 8 carbon atoms, optionally substituted cycloalkyl and optionally substituted aryl.

43. (Original) The process according to claim 42, wherein D is NR^{10}, wherein R^{10} is selected from the group consisting of $S(O)_2R^{10}$, $P(O)(R^{10})_2$, $C(O)R^{10}$, $C(O)N(R^{10})_2$ and $C(S)N(R^{10})_2$, in which R^{10} is independently selected from the group consisting of hydrogen, optionally substituted linear and branched alkyl and alkenyl containing 1 to 8 carbon atoms, optionally substituted cycloalkyl and optionally substituted aryl.

44. (Original) The process according to claim 42, wherein the diamine is chiral and includes (1) compounds in which the amine-bearing center is stereogenic, (2) compounds in which both the donor-bearing (D) and amine-bearing centers are stereogenic.

45. (Original) The process according to claim 44, wherein the diamine is $CH_3C_6H_4SO_3NCHPhCHPhNH_2$.

46. (Previously Amended) The process according to claim 1, wherein the ligands X and Y is selected from the group consisting of Cl, Br, I, H, hydroxy, alkoxy and acyloxy.

47. (Previously Amended) The process according to claim 1, wherein the base is an alcoholate or an hydroxide salt selected from the group consisting of compounds of the Formula $(R^{12}O)_2M'$ and $R^{12}OM''$, in which M' is an alkaline-earth metal, M'' is an alkaline metal and R^{12} is selected from the group consisting of hydrogen, C_1 to C_6 linear and branched alkyl.

48. (Previously Amended) The process according to claim 1, wherein the base is an organic non-coordinating base.

49. (Original) The process according to claim 48, wherein the base is selected from the group consisting of DBU, NR_3 and phosphazene.

50. (Previously Amended) The process according to claim 1, wherein the hydrogenation is carried out in the absence of a solvent.

51. (Previously Amended) The process according to claim 1, wherein the hydrogenation reaction is carried out in the presence of a solvent.

52. (Original) The process according to claim 51, wherein the solvent is selected from the group consisting of benzene, toluene, xylene, hexane, cyclohexane, tetrahydrofuran, primary and secondary alcohols, and mixtures thereof.

53. (Original) The process according to claim 51, wherein the hydrogenation is carried out in an amine solvent.

54-56. (Previously Cancelled)